

Amendments to the Claims:

The following Listing of Claims will replace all prior versions, and listings, of claims in the application:

Listing of Claims

This listing of claims will replace all prior versions, and listings, of claims in the application.

1. – 6. (Canceled)

7. (Currently amended) ~~The device of claim 1;~~ A touch sensing device, comprising:
a touch panel;

a plurality of sensors coupled to the touch panel, the plurality of sensors configured to sense bending waves in the touch panel and generate a bending wave signal responsive to the sensed bending waves;

a transducer coupled to the touch panel and configured to induce bending waves in the touch panel; and

a controller coupled to the plurality of sensors, the controller configured to identify an untouched condition signal responsive to the induced bending waves, compare the untouched condition signal to the bending wave signal, and detect a touch on the touch panel based on the comparison, wherein the transducer is configured to induce bending waves in the touch panel at a frequency greater than or equal to half the sampling frequency used by the controller.

8. (Currently amended) ~~The device of claim 1;~~ A touch sensing device, comprising:
a touch panel;

a plurality of sensors coupled to the touch panel, the plurality of sensors configured to sense bending waves in the touch panel and generate a bending wave signal responsive to the sensed bending waves;

a transducer coupled to the touch panel and configured to induce bending waves in the touch panel, wherein the transducer is configured to induce bending waves in the touch panel at a frequency associated with an aliased untouched condition signal; and

a controller coupled to the plurality of sensors, the controller configured to identify an untouched condition signal responsive to the induced bending waves, compare the untouched condition signal to the bending wave signal, and detect a touch on the touch panel based on the comparison.

9. (Original) The device of claim 8, wherein the aliased untouched condition signal comprises a signal having a frequency less than or equal to an audio band frequency.

10. (Original) The device of claim 8, wherein the aliased untouched condition signal comprises a DC signal.

11. (Canceled)

12. (Currently amended) ~~The device of claim 1;~~ A touch sensing device, comprising:
a touch panel;

a plurality of sensors coupled to the touch panel, the plurality of sensors configured to sense bending waves in the touch panel and generate a bending wave signal responsive to the sensed bending waves;

a transducer coupled to the touch panel and configured to induce bending waves in the touch panel; and

a controller coupled to the plurality of sensors, the controller configured to identify an untouched condition signal responsive to the induced bending waves, wherein the controller is configured to determine an amplitude of the untouched condition signal, compare the untouched condition signal amplitude to an amplitude of the bending wave signal, and detect the touch based on the comparison.

13. (Original) The device of claim 12, wherein the amplitude is an RMS amplitude.

14. (Currently amended) ~~The device of claim 1;~~ A touch sensing device, comprising:
a touch panel;

a plurality of sensors coupled to the touch panel, the plurality of sensors configured to sense bending waves in the touch panel and generate a bending wave signal responsive to the sensed bending waves;

a transducer coupled to the touch panel and configured to induce bending waves in the touch panel; and

a controller coupled to the plurality of sensors, the controller configured to identify an untouched condition signal responsive to the induced bending waves, wherein the controller is configured to determine a spectrum of the untouched condition signal, compare the untouched condition signal to a spectrum of the bending wave signal, and detect the touch based on the comparison.

15. (Currently amended) ~~The device of claim 1;~~ A touch sensing device, comprising:

a touch panel;

a plurality of sensors coupled to the touch panel, the plurality of sensors configured to sense bending waves in the touch panel and generate a bending wave signal responsive to the sensed bending waves;

a transducer coupled to the touch panel and configured to induce bending waves in the touch panel; and

a controller coupled to the plurality of sensors, the controller configured to identify an untouched condition signal responsive to the induced bending waves, wherein the controller comprises an adaptive filter having a plurality of reference filter coefficients selected to cancel the untouched condition signal and the controller is configured to calculate the filter coefficients to cancel the bending wave signal, compare the calculated filter coefficients to the reference filter coefficients and detect a touch based on the comparison.

16. (Currently amended) The device of claim ~~1~~15, wherein the controller is further configured to determine the location of the touch after detecting the touch.

17. (Currently amended) The device of claim ~~1~~15, wherein the controller is further configured to detect a touch lift off from the touch panel after detecting the touch.

18. (Canceled)

19. (Currently amended) The device of claim 15, wherein the controller is configured to detect a touch lift off from the touch panel if the bending wave signal returns to the untouched condition signal.

20. – 30 (Canceled)

31. (Currently amended) ~~The method of claim 27;~~ A method for determining touch information, comprising:

inducing bending waves in a touch panel ~~wherein inducing the bending waves in the touch panel using the driving signal comprises inducing the bending waves in the touch panel using a driving signal associated with an aliased untouched condition signal;~~

identifying an untouched condition signal responsive to the induced bending waves;

generating a bending wave signal responsive to a touch on the touch panel;

comparing the bending wave signal and the untouched condition signal; and

detecting the touch on the touch panel based on the comparison.

32. (Currently amended) ~~The method of claim 27;~~ A method for determining touch information, comprising:

inducing bending waves in a touch panel using a driving signal;

identifying an untouched condition signal responsive to the induced bending waves;

generating a bending wave signal responsive to a touch on the touch panel;

comparing the bending wave signal and the untouched condition signal;

detecting the touch on the touch panel based on the comparison; and

further comprising updating the identified untouched condition signal based on non-touch related conditions.

33. (Original) The method of claim 32, wherein updating the identified untouched condition signal comprises updating the identified untouched condition signal due to component drift.

34. (Original) The method of claim 32, wherein updating the identified untouched condition signal comprises periodically updating the identified untouched condition on a timescale selected to be long compared to a touch duration.

35. – 37 (Canceled)

38. (Currently amended) ~~The method of claim 27, wherein:~~ A method for determining touch information, comprising:

inducing bending waves in a touch panel using a driving signal;

identifying ~~the~~ an untouched condition signal ~~comprises~~ by selecting a plurality of reference filter coefficients of an adaptive filter to cancel the untouched condition signal;

generating a bending wave signal responsive to a touch on the touch panel;

~~comparing the bending wave signal and the untouched condition signal comprises~~ calculating filter coefficients to cancel the bending wave signal and comparing the calculated filter coefficients to the reference filter coefficients; and

~~detecting the touch based on the comparison comprises~~ detecting the touch based on a difference between the calculated filter coefficients and the reference filter coefficients.

39. – 43 (Canceled)

44. (Currently amended) ~~The method of claim 39, wherein inducing the bending waves in the touch panel using a driving signal comprises~~ A method for determining touch information, comprising:

inducing the bending waves in the touch panel using a driving signal associated with an aliased untouched condition signal;

identifying an untouched condition signal responsive to the induced bending waves;

generating a bending wave signal responsive to a touch on the touch panel;
detecting a touch on the touch panel;
comparing the bending wave signal and the untouched condition signal after the touch is
detected; and
detecting a touch lift off from the touch panel based on the comparison.

45. -- 46 (Canceled)

47. ~~The method of claim 39, wherein:~~ A method for determining touch information,
comprising:

inducing bending waves in a touch panel using a driving signal;
identifying the untouched condition signal responsive to the induced bending waves
~~comprises by selecting a plurality of reference filter coefficients of an adaptive filter to cancel the~~
untouched condition signal; and

generating a bending wave signal responsive to a touch on the touch panel;
detecting a touch on the touch panel;
~~comparing the bending wave signal and the untouched condition signal comprises:~~
calculating filter coefficients to cancel the bending wave signal; and
comparing the calculated filter coefficients to the reference coefficient; and detecting a
touch lift off from the touch panel based on the comparison.

48. (Canceled)

49. (Currently amended) ~~The method of claim 39, further comprising:~~ A method for
determining touch information, comprising:

inducing bending waves in a touch panel using a driving signal;
identifying an untouched condition signal responsive to the induced bending waves;
generating a bending wave signal responsive to a touch on the touch panel;
detecting a touch on the touch panel;

comparing the bending wave signal and the untouched condition signal after the touch is detected;

detecting a touch lift off from the touch panel based on the comparison;

generating a wake on touch signal responsive to the touch; and

energizing the emitting transducer if the wake on touch signal is generated.

50. – 55 (Canceled)

56. (Currently amended) ~~The system of claim 55, further comprising:~~ A system for determining touch lift off information, comprising:

means for inducing bending waves in a touch panel using a driving signal;

means for identifying an untouched condition signal responsive to the induced bending

waves;

means for generating a bending wave signal responsive to a touch on the touch panel;

means for detecting the touch on the touch panel;

means for comparing the bending wave signal and the untouched condition signal;

means for detecting a touch lift off from the touch panel based on the comparison;

means for generating a wake on touch signal responsive to the touch; and

means for energizing the emitting transducer if the wake on touch signal is generated.